

## Combined Science Revision

### Question 1

Outline how industrial gases are manufactured from air.

### Solution 1

- Air is cooled to  $-78^{\circ}\text{C}$ .
  - Water and carbon dioxide are removed as solids.
  - The remaining air is further cooled by a process of rapid compression and expansion until it reaches a temperature of  $-200^{\circ}\text{C}$ .
  - At this temperature all gases are liquids except for rare gases.
  - The liquefied gases are pumped into the the fractionating tower an the temperature allowed to rise gradually.
  - Nitrogen which has a boiling point of  $-196^{\circ}\text{C}$  turns to gas and is collected.
  - Oxygen which has a boiling point of  $-183^{\circ}\text{C}$  is collected as a liquid from the bottom of the tower.
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### Question 2

Breast milk is said to be a balanced diet. The World Health Organisation and the Ministry of Health and Child Welfare encourage breast feeding for 18 months instead of bottle feeding.

- (a)(i) State the food components present in breast milk.
- (ii) What reasons are given to support breast feeding instead of bottle feeding?
- (b) Describe how active immunity is aquired after a child has been vaccinated.

### Solution 2

(a)(i)

- fats
- water
- carbohydrates
- minerals
- proteins

(ii) Breast milk:

- is not contaminated
- is at a suitable temperature
- contains antibodies which defend the baby against disease

(b) The child is injected with weakened or dead pathogens. White blood cells produce antibodies to fight the pathogens. After recovery, the body keeps the antibodies to fight future infections.

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### Question 3

A farmer realised that germination in one of his fields was poor. Suggest three possible reasons for the poor germination.

### Solution 3

- lack of moisture
  - lack of oxygen
  - unsuitable temperature
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### Question 4

A model of a hydraulic jack of velocity ratio 100 and mechanical advantage 50 is used to lift a toy car.

(a)(i) Calculate the efficiency of the jack.

(ii) Explain why the efficiency is not 100%.

(b) The hydraulic jack relies on the transmission of pressure in fluids.

(i) Define pressure.

(ii) State three advantages of using oil in the hydraulic jack.

### Solution 4

$$\begin{aligned} \text{(a)(i) Efficiency} &= (\text{MA} \div \text{VR}) \times 100 \\ &= (50 \div 100) \times 100 \\ &= 50\%. \end{aligned}$$

(ii) Some of the energy:

- is lost in overcoming friction.

- is used against the weight of the moving parts.

(b)(i) Pressure is the force per unit area.

(ii) Oil:

- cannot be easily compressed
  - transmits pressure equally in all directions
  - reduces friction of the pistons
  - prevents rusting of the hydraulic jack components.
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## Question 5

(a) Describe the functions of the following blood components.

1. White blood cells
2. Platelets
3. Red blood cells

(b) State two types of immunity.

## Solution 5

1. White blood cells - antibody production and engulfing pathogens.
2. Platelets - blood clotting.
3. Red blood cells - transporting oxygen.

(b) Artificial and natural immunity.

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## Question 6

Water loss from a maize plant was measured over a period of 24 hours as shown in the table below:

Time period	Water loss (cm <sup>3</sup> )
0500 - 0700	13
0700 - 0900	91
0900 - 1100	160
1100 - 1300	218

Time period	Water loss (cm <sup>3</sup> )
1300 - 1500	248
1500 - 1700	195
1700 - 1900	179
1900 - 2100	124
2100 - 2300	28
2300 - 0100	18
0100 - 0300	18
0300 - 0500	13

(a) Using the table above, identify with reasons, periods during which water loss is highest and lowest.

(b) Describe ways in which plants are adapted to reduce water loss.

## Solution 6

(a) Highest - 1300 to 1500 hrs

Lowest - 0300 to 0500 hrs and 0500 to 0700 hrs

Explanation:

Highest → This is caused by increased light and heat and reduced humidity; all of which increase the evaporation of water from the leaves.

Lowest → water loss is reduced as the temperature drops, light intensity drops and humidity increase because the rate at which water evaporates from the leaves is low under these conditions.

(b) Plants are adapted for water loss in the following ways:

- fewer stomata on the surface of the leaf
- presence of hairs on the surface of the leaf
- reduced leaf size

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## Question 7

Iron pyrites is used as a source of sulphur dioxide in the manufacture of sulphuric acid in Zimbabwe.

- (a) Describe briefly how sulphur trioxide is obtained from iron pyrites.
- (b) Describe and explain how sulphur trioxide is converted to sulphuric acid.

## Solution 7

(a) Iron pyrites (iron sulphide) is roasted in air to produce sulphur dioxide. Sulphur dioxide is then oxidised to sulphur trioxide at  $450^{\circ}\text{C}$ , 1 atm using vanadium (v) oxide as a catalyst.

(b) Sulphur trioxide is absorbed in concentrated sulphuric acid to produce oleum. Sulphur trioxide is not directly added to water because the heat of reaction would produce a mist of sulphuric acid that is difficult to condense. Oleum is then diluted with water to obtain more concentrated sulphuric acid.

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